

# TC74HCT688AP, TC74HCT688AF

## 8-Bit Equality Comparator

The TC74HCT688A is a high speed CMOS 8-BIT EQUALITY COMPARATOR fabricated with silicon gate C<sup>2</sup>MOS technology.

It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

This device may be used as a level converter for interfacing TTL or NMOS to High Speed CMOS. The inputs are compatible with TTL, NMOS and CMOS output voltage levels.

The TC74HCT688A compares two 8-bit binary or BCD words applied inputs P<sub>0</sub> thru P<sub>7</sub>, and inputs Q<sub>0</sub> thru Q<sub>7</sub>, and indicates whether or not they are equal.

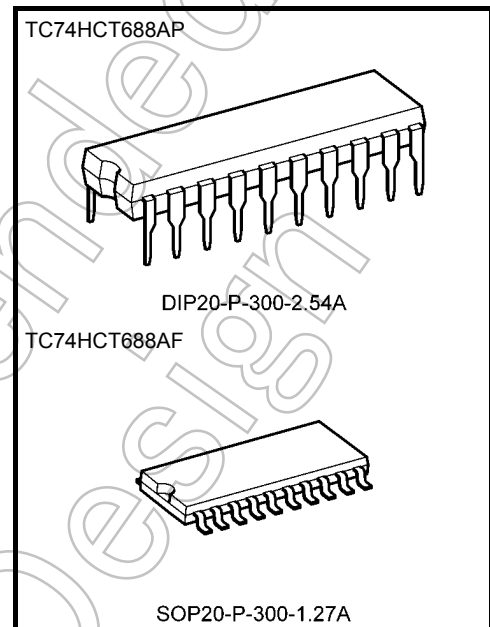
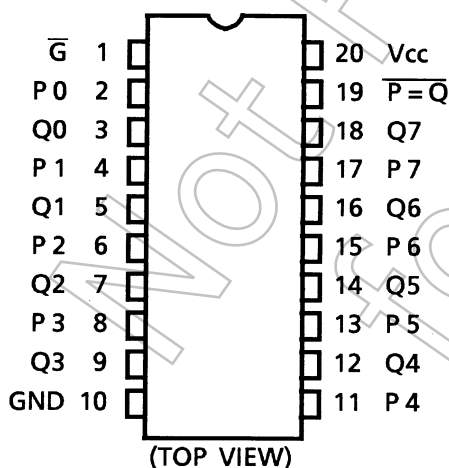
A signal active low enable is provided to facilitate cascading of several packages to compare words greater than 8 bits.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.

### Features

- High speed:  $t_{pd} = 17 \text{ ns (typ.)}$  at  $V_{CC} = 5 \text{ V}$
- Low power dissipation:  $I_{CC} = 4 \mu\text{A (max)}$  at  $T_a = 25^\circ\text{C}$
- Compatible with TTL outputs:  $V_{IH} = 2.0 \text{ V (min)}$   
 $V_{IL} = 0.8 \text{ V (max)}$
- Output drive capability: 10 LSTTL loads
- Symmetrical output impedance:  $|I_{OH}| = I_{OL} = 4 \text{ mA (min)}$
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Pin and function compatible with 74LS688

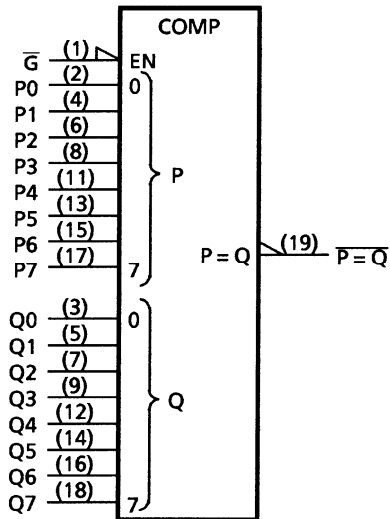
### Pin Assignment



Weight		
DIP20-P-300-2.54A	:	1.30 g (typ.)
SOP20-P-300-1.27A	:	0.22 g (typ.)

Start of commercial production  
1988-11

**IEC Logic Symbol**

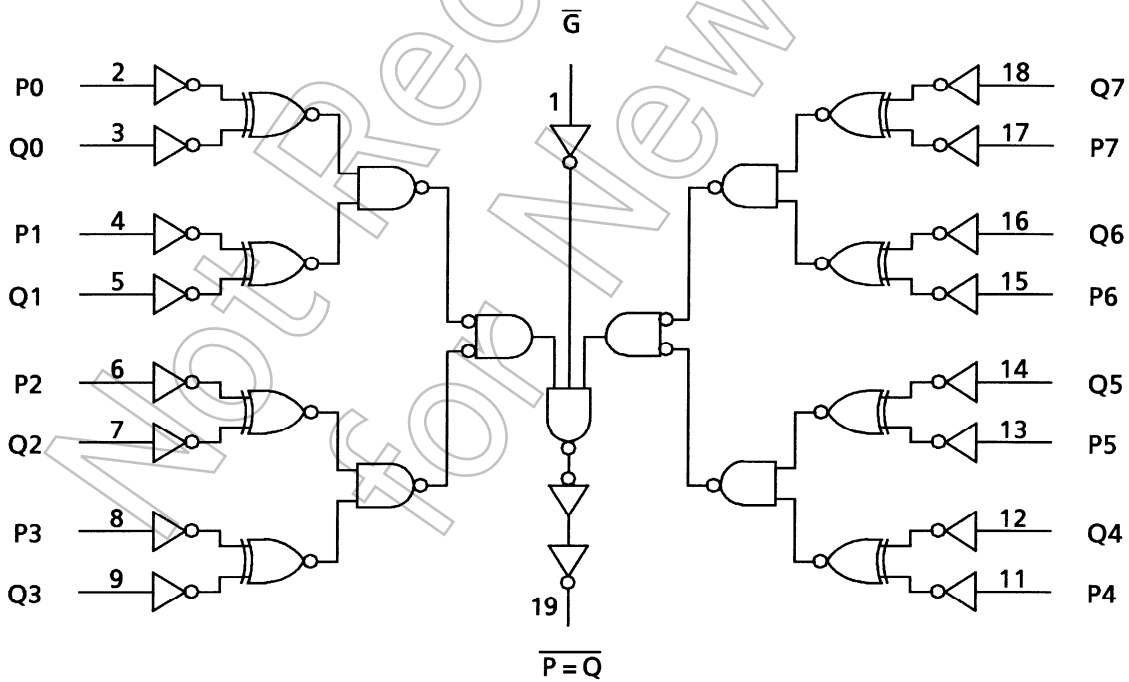


**Truth Table**

Inputs		Output
P, Q	$\bar{G}$	$\overline{P=Q}$
P = Q	L	L
P $\neq$ Q	L	H
X	H	H

X: Don't care

**System Diagram**



**Absolute Maximum Ratings (Note 1)**

Characteristics	Symbol	Rating	Unit
Supply voltage range	$V_{CC}$	-0.5 to 7.0	V
DC input voltage	$V_{IN}$	-0.5 to $V_{CC} + 0.5$	V
DC output voltage	$V_{OUT}$	-0.5 to $V_{CC} + 0.5$	V
Input diode current	$I_{IK}$	±20	mA
Output diode current	$I_{OK}$	±20	mA
DC output current	$I_{OUT}$	±25	mA
DC $V_{CC}$ /ground current	$I_{CC}$	±50	mA
Power dissipation	$P_D$	500 (DIP) (Note 2)/180 (SOP)	mW
Storage temperature	$T_{stg}$	-65 to 150	°C

Note 1: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 2: 500 mW in the range of  $T_a = -40$  to  $65^\circ\text{C}$ . From  $T_a = 65$  to  $85^\circ\text{C}$  a derating factor of  $-10 \text{ mW}/^\circ\text{C}$  should be applied up to 300 mW.

**Operating Ranges (Note)**

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	4.5 to 5.5	V
Input voltage	$V_{IN}$	0 to $V_{CC}$	V
Output voltage	$V_{OUT}$	0 to $V_{CC}$	V
Operating temperature	$T_{opr}$	-40 to 85	°C
Input rise and fall time	$t_r, t_f$	0 to 500	ns

Note: The operating ranges must be maintained to ensure the normal operation of the device. Unused inputs must be tied to either  $V_{CC}$  or GND.

**Electrical Characteristics**

**DC Characteristics**

Characteristics	Symbol	Test Condition	$T_a = 25^\circ\text{C}$			$T_a = -40$ to $85^\circ\text{C}$		Unit		
			$V_{CC}$ (V)	Min	Typ.	Max	Min		Max	
High-level input voltage	$V_{IH}$	—	4.5 to 5.5	2.0	—	—	2.0	—	V	
Low-level input voltage	$V_{IL}$	—	4.5 to 5.5	—	—	0.8	—	0.8	V	
High-level output voltage	$V_{OH}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -20 \mu\text{A}$	4.5	4.4	4.5	—	4.4	—	V
			$I_{OH} = -4 \text{ mA}$	4.5	4.18	4.31	—	4.13	—	
Low-level output voltage	$V_{OL}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 20 \mu\text{A}$	4.5	—	0.0	0.1	—	0.1	V
			$I_{OL} = 4 \text{ mA}$	4.5	—	0.17	0.26	—	0.33	
Input leakage current	$I_{IN}$	$V_{IN} = V_{CC}$ or GND	5.5	—	—	±0.1	—	±1.0	μA	
Quiescent supply current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND	5.5	—	—	4.0	—	40.0	μA	
	$I_C$	Per input: $V_{IN} = 0.5 \text{ V}$ or $2.4 \text{ V}$ Other input: $V_{CC}$ or GND	5.5	—	—	2.0	—	2.9	mA	

### AC Characteristics ( $C_L = 15 \text{ pF}$ , $V_{CC} = 5 \text{ V}$ , $T_a = 25^\circ\text{C}$ , input: $t_r = t_f = 6 \text{ ns}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Output transition time	$t_{TLH}$ $t_{THL}$	—	—	6	12	ns
Propagation delay time ( $P_n, Q_n - \overline{P=Q}$ )	$t_{pLH}$ $t_{pHL}$	—	—	17	27	ns
Propagation delay time ( $\overline{G - P=Q}$ )	$t_{pLH}$ $t_{pHL}$	—	—	12	19	ns

### AC Characteristics ( $C_L = 50 \text{ pF}$ , input: $t_r = t_f = 6 \text{ ns}$ )

Characteristics	Symbol	Test Condition	$T_a = 25^\circ\text{C}$			$T_a = -40 \text{ to } 85^\circ\text{C}$		Unit	
			$V_{CC} \text{ (V)}$	Min	Typ.	Max	Min		Max
Output transition time	$t_{TLH}$	—	4.5	8	15	—	19	ns	
	$t_{THL}$		5.5	—	7	13	—		16
Propagation delay time ( $P_n, Q_n - \overline{P=Q}$ )	$t_{pLH}$	—	4.5	—	21	32	—	40	ns
	$t_{pHL}$		5.5	—	18	29	—	36	
Propagation delay time ( $\overline{G - P=Q}$ )	$t_{pLH}$	—	4.5	—	15	23	—	29	ns
	$t_{pHL}$		5.5	—	13	21	—	26	
Input capacitance	$C_{IN}$	—	—	5	10	—	10	pF	
Power dissipation capacitance	$C_{PD}$ (Note)	—	—	32	—	—	—	pF	

Note:  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

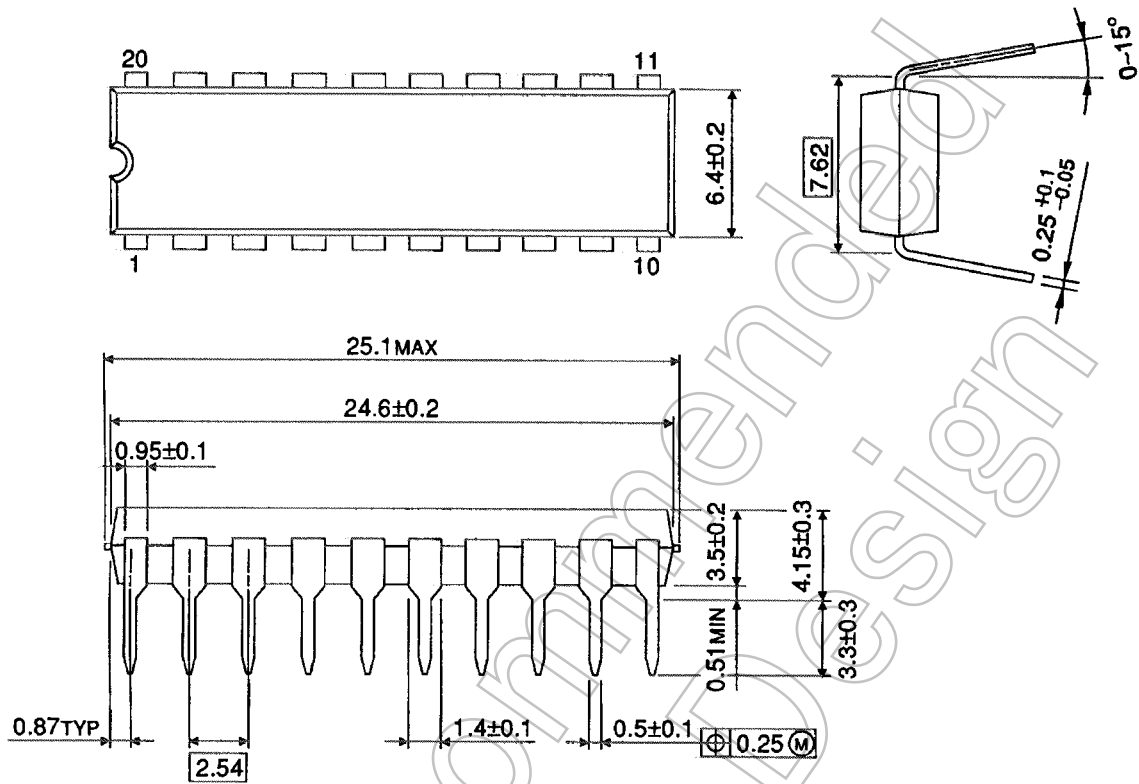
Average operating current can be obtained by the equation:

$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

## Package Dimensions

DIP20-P-300-2.54A

Unit : mm



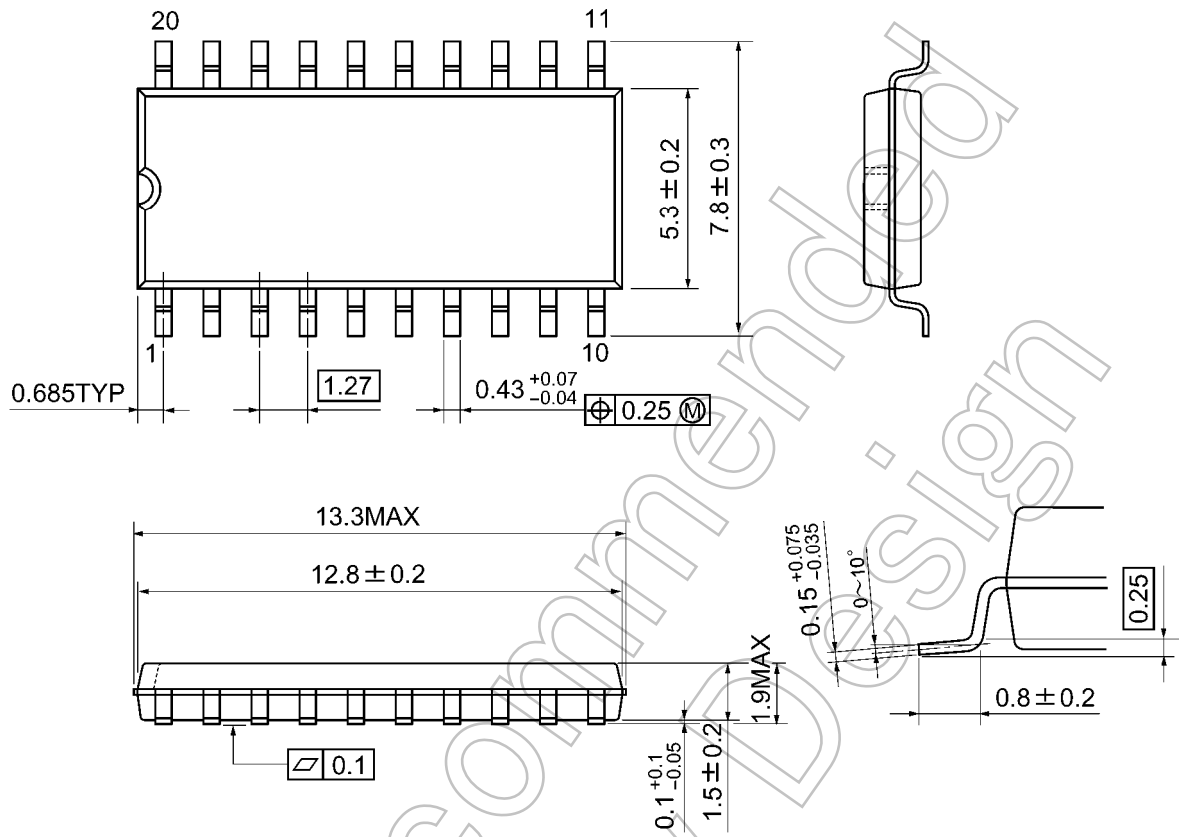
Weight: 1.30 g (typ.)

Not Recommended for New Design

**Package Dimensions**

SOP20-P-300-1.27A

Unit: mm



Weight: 0.22 g (typ.)

Not Recommended for New Design

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